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ABSTRACT

This study investigated the effects of microcomputer usage on the educational experiences of a low vision high school student. Ethnographic research methodology was utilized to conduct the single-subject study. Participant observation provided data, with interviewing of key individuals in the student's school and home environments providing substantiating data. A document review of school records was done. Field notes were recorded in raw form, transcribed into final form and organized into 52 reports. An item index was developed from the original research questions to analyze observed behaviors. The analysis of the data showed that microcomputer usage positively affected the student's educational experiences. The microcomputer increased the student's participation in classes and peer interactions and heightened his self-esteem. (Author/CL)

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MICROCOMPUTER USAGE BY A LOW VISION STUDENT:

A CASE STUDY

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Abstract

This study investigated the effects of microcomputer usage on the educational experiences of a low vision student. Ethnographic research methodology was utilized to conduct the single-subject study. Participant observation provided data, with interviewing of key individuals in the student's school and home environments providing substantiating data. A document review of school records was done. Field notes were recorded in raw form, transcribed into final form and organized into fifty-two reports. An item index was developed from the original research questions to analyze observed behaviors. The analysis of the data showed that microcomputer usage impacted positively on the student's educational experiences.

Introduction

Computers have been used in education for instruction and administration, as well as in training of computer personnel for several decades. A variety of uses of microcomputers by handicapped pupils is currently being developed. Blind and low vision pupils have great potential for utilization of the microcomputer. Visually handicapped individuals often have difficulties handling media which sighted persons utilize daily; they often lack access to new technology when adaptations cannot be made quickly or readily. Individuals with low vision may have sufficient residual vision to permit the reading of print sources, such as a video monitor of a microcomputer. Some visual conditions are more adaptible to a negative print image like the image on the monitor than to a positive image of standard printed material. Adaptations have been developed by various manufacturers and computer research teams which enable blind and low vision persons to have access to microcomputers with alternate output formats, such as spoken or braille output modes. The Optacon (Optical to Tactile Converter) has a special attachment for scanning the CRT, the monitor of a computer screen. Microcomputer technology is so new to education that little research exists to date, especially in relation to the applications for special populations. For visually impaired individuals to share in the benefits of this new technology, they will need to deal with it in some way.

Purpose of the Study

The purpose of this study was to investigate the impact of microcomputer utilization on the educational experiences of a single low

vision subject over a specified period of time. The investigator sought to provide an in-depth view of the effects over a time period spanning eight months, including an entire school semester. The subject's use of residual vision for reading the microcomputer monitor and for other visual tasks was important to the study. The effect of microcomputer usage on completion of homework for classes in which he was mainstreamed with nonhandicapped peers was also studied. This study sought to identify potential research questions for microcomputer usage by low vision individuals.

Research Design and Methodology

This study used ethnographic research methodology in observation of a single low vision student functioning within a culture primarily comprised of a secondary school educational environment. Ethnographic research techniques are predominantly used for social science investigations. These techniques facilitate more depth for study and permit the researcher to document the process of change over time.

The student, Robert (Rob), was a senior in a small high school located in a farming community. Rob's visual condition was diagnosed within the limits of legal blindness, with monocular vision reduced to 20/200 or less and a contracted visual field. He attended regular high school classes with resource room help from the teacher for the visually handicapped. Rob's family is middle-class; his father works with computers for a large business in the community. The research was conducted in the settings of school and Rob's home; in both settings he had access to microcomputers. The study spanned eight months, including an entire school semester in the 1982-1983 school year.

Triangulation of data involved three main data sources. Participant

observation in the school setting and the home setting provided most of the data. Interviewing of the subject, his parents, physicians and teachers provided substantiating data, as did the study of available school records.

Participant observation was conducted in the high school classes from September, 1982 to January, 1983. Documents were reviewed in the school office during February, 1983. Other contacts started in July, 1982 with the family at home. Interviews were recorded in November, 1982; December, 1982; January, 1983 and February, 1983.

Field notes were recorded in raw form and transcribed into a microcomputer word processing program. The final volume of field notes included 390 pages of notes on observations, interview transcriptions, and the document review. The notes were organized into fifty-two reports, with a summary coversheet for each report. An item index of twenty-two major variables was developed from the research questions and from the emerging patterns of the data during the course of the study. Each variable had three to seven subvariables (e. g., "Interaction with peers in situations where microcomputer is used: a. Very active, b. Moderately active, c. Mildly active, d. Withdrawn or inactive"). Several minor variables were also recorded within the field notes. Fieldnotes were coded using the variables and subvariables of the item index. Frequencies for all observed occurrences were recorded and tallied. Coding frequencies were used for the data analysis.

The intense nature of data collection in the methodology through participant observation, interviewing, and the study of documents and artifacts was guided by the researcher's objective investigative attitude. The researcher was the instrument of the methodology, attempting to

accurately report and reconstruct the human behaviors observed in the cultural setting. The researcher gathered information according to Rob's basic class schedule, making adjustments as needed. The researcher formulated conclusions; results of these conclusions were reported in a dissertation.

The population for the study was Rob, as a single case study. Because the study was done in naturalistic settings, other individuals were instrumental during the information collection process. The members of Rob's family and classmates in school, the ophthalmologist, and the family physician provided information. Other individuals with whom Rob had peripheral contact also provided information for the study. Descriptive statistics were included when the measures provided information useful to analyses of events or situations encountered in the field research.

Discussion

The use of ethnographic research methodology, a qualitative research methodology utilized primarily in the social sciences, permitted more depth for data collection. Ethnography and other qualitative research methodologies allow the researcher to document either the process of change or consistent behavior over time. Triangulation of data provided the researcher with substantiation in documenting behaviors observed in the subject. The single subject design and use of qualitative research were appropriate in the study of a low vision individual because the handicap falls in the range of low incidence impairments which do not occur frequently in the general population.

Analysis of the data indicated that visual functioning was a key element in Rob's ability to use the microcomputer. Rob's residual vision

fluctuated almost daily, which made some kinds of visual use difficult or impossible. Rob did not read fine print at all, and did not read regular print with a positive image (black on white) quickly enough to use print materials effectively for classwork on a consistent basis. Observing his behavior at different visual tasks established that the microcomputer screen was one print source which he could read on a consistent basis, except at times of severe visual fluctuations. The capability of the microcomputer to generate larger characters enabled Rob to read the video monitor even with visual fluctuations. When the loss was most severe, in January, 1983, Rob did not even read with the microcomputer.

The data supported the concept that Rob learns best through listening. In classes where the chalkboard was central to class activity, Rob was less active than in classes where he was able to obtain information through listening. Geometry was an example of a class where students must see the chalkboard to achieve. The visual characteristics of a chalkboard are similar to those of a microcomputer but the quality is far different. Distance presents a problem with chalkboards. Handwriting of different individuals cannot be controlled. The visual cues are light (chalk) on dark (board), but the contrasts are not distinct as on the microcomputer monitor. For a low vision student who learns best through listening or very close print reading, the chalkboard hinders the learning process. Interactions with both peers and teachers in such cases would be limited by the inability to use the medium for full participation. Regular class teachers would not necessarily recognize reduced participation and lack of interaction as related to chalkboard use. The behavior could be mistaken for lack of motivation or poor attitude, which was the case with Rob's

teachers.

Microcomputer utilization provided Rob more participation in a variety of experiences, including classes and peer interactions. Using the microcomputer gave Rob access to the same kinds of materials and experiences sighted peers could enjoy with a print medium. Microcomputer use allowed Rob to be a more active participant in some situations. For example, a report regarding the use of microcomputers given in the Consumer Economics class of the second nine weeks during the fall of 1982 established Rob as an expert. The report had been composed on the microcomputer and looked good in final form. Students responded well to his presentation.

Rob's self-esteem was heightened in several ways with the use of the microcomputer. He had good knowledge of many computer terms and programmed using BASIC and PASCAL. Rob experienced success with the microcomputer and developed expertise to make the technology work for him. He could make the microcomputer do what he wanted it to do without the need for dependence on other people. Rob became a more effective and creative individual. He was recognized as an expert in the school setting by peers and teachers alike. Rob became a person on whom nonhandicapped peers could depend for help with the technology.

If Rob had difficulties with completion of class work, he got behind in his classes. Having the printer at home gave him an opportunity to catch up with assignments more quickly and efficiently than doing the makeup work tediously by hand, which he often could not read anyway. Rob's parents did not purchase the printer until about the midpoint of the study, so the difference was documented from that point in time. This development

generated the initiative for Rob to ask permission to redo English homework. With the microcomputer he could read his own work, change it easily, expand and correct the work before turning assignments in to the teacher. Rob also took the initiative to spend his out-of-class hours to make up Chemistry work, although this work was not done on the microcomputer. Rob knew that the course completion would be necessary for him to enroll in a computer science major in college. The possibilities of computer work for his vocational future and the reality of the microcomputer for homework completion generated changes in Rob's behavior which were important. Had the line printer been available earlier in the first semester, Rob might not have fallen behind. When he had access to the printer consistently, completion of assignments was reported to have improved, both for quality and for quantity. The pattern of not organizing or accepting responsibility for homework completion began to shift when the resources were available to him. Rob's good self-concept in relation to his ability to produce with the microcomputer gave him the impetus to follow up on completion of work and rewriting of less acceptable assignments.

Rob's interest in the microcomputer and in computer science generated the initiative to take classes which would prepare him for applied computer sciences studies in college. He had not taken enough mathematics and science courses and recognized the need for the skills when he decided that he wanted to be a computer specialist. Once Rob had established an activity in which he felt competent and successful, he moved from a passive role to a more active role in the control of his life. Rob had previously allowed decisions to be made for him and plans to be made for him.

According to his parents and the resource teacher, he had not previously seemed interested in controlling factors in his life.

Expectations of his parents and of the resource teacher for the visually handicapped were high. Expectations of others were low to moderate, with the exception of expectations concerning his computer expertise. Teachers and parents expressed the feeling that he functioned as a handicapped individual in most situations (especially the regular classroom) unless adaptations were made, in which case Rob could function more effectively. For microcomputer usage, Rob was not viewed as handicapped. The microcomputer was never perceived by persons close to Rob as a unique adaptive appliance.

Rob interacted primarily with special education students in both his special education class settings and in his regular division class setting. He rarely interacted with nonhandicapped students in any class settings except Chemistry. The nonhandicapped student with whom Rob interacted in Chemistry on a consistent basis had been a classmate since elementary school days. Rob did not initiate many contacts with nonhandicapped peers, but began to do so during his senior year.

In settings where the microcomputer was central, Rob interacted on a limited but intense basis with peers who were nonhandicapped. The limitations involved one-to-one interaction. By his own admission, Rob preferred working with individuals. He did not interact as much when additional people joined the activity with the microcomputer while he tutored Greg, his friend, in the high school library. Rob indicated that two boys had become his good friends through microcomputer use. One was an individual from a computer camp the summer before his senior year in high

school, Greg, the other. This kind of interaction was a change from previous years, according to Rob's parents and the resource teacher for the visually impaired.

Rob demonstrated a tendency to interact primarily with special education personnel either in special class settings or in regular classrooms where he received special support. Interactions with regular class teachers were less frequent. In some cases he seemed to be inactive or withdrawn. The nature of the class seemed to influence these interactions. In classes where he could listen, he interacted more. He interacted less in classes requiring heavy reliance on visual materials, especially the chalkboard, and visual use.

Rob did interact more positively with regular education personnel when he could use the microcomputer to complete homework. Expectations of regular personnel for Rob were only moderate, except when computer knowledge and utilization were considered. His interactions with the English teacher and the Consumer Economics teachers for the second nine weeks were increased when he used the microcomputer to redo homework and write/present a final project. Using the microcomputer improved his ability to communicate in an acceptable manner for classwork purposes.

As noted earlier, using the microcomputer allowed Rob to complete some asignments with great success and to redo other assignments to improve the quality of his work. The impact on homework completion was limited, however. Homework which might ordinarily have been done on a typewriter could be done using the word processing program. Other kinds of work, for example Geometry and Chemistry, could not be done because appropriate software was not available. Rob's Geometry teacher felt that such software

would be a future possibility, but Rob would be out of high school when it became a reality. If the communication tool had been accessible for Chemistry and Geometry classes, perhaps Rob's class participation might have improved and achievement could have been higher. The technology was so new at the time of this study that many teachers did not have the expertise to create software which would provide the same instructional material as the texts provided. Rob was actually ahead of the education field in terms of his ability to use the technology.

More research is needed in special education applications of microcomputer technology, especially with regard to visually impaired users. Evaluation and comparison of microcomputer monitors among different brands should be made. Contrasts of background with print characters need consideration, as well as angle and size of characters. Different visual conditions may require different video monitor characteristics for optimal utilization.

Software development of classroom materials for general use by low vision students should be explored. In addition to teacher-prepared computer assisted instructional software, great potential exists for textual materials to be stored on diskettes. Accessibility of textual material for low vision students is the key to achievement, especially in mainstreaming situations where competition with nonhandicapped peers is important. Microcomputers will be used in public education and are not considered adaptive aids. Visually handicapped students using microcomputers will not be considered different from nonhandicapped peers.

Achievement studies of low vision students who read materials provided for microcomputer usage should be compared with achievement of low vision

students who read materials provided in taped form or in large print form. Higher achievement might be expected in students who were handling the reading medium well.

Output modes are presently being developed which allow more than a single output source for individuals with fluctuating vision. Audio output especially will enhance the potential for microcomputer usage by low vision and blind individuals. Such development should seek to minimize costs and maximize utility for low vision individuals.

Special educators need to ensure accessibility to microcomputer technology for visually handicapped students. Even severely visually limited youngsters can benefit from computer literacy, with some adaptations. The medium may need no adaptations for low vision students and may facilitate the interactions of students with nonhandicapped peers on an equal basis, enhancing regular education participation. Educators of the visually impaired need to have computer skills to instruct these students, as well as having knowledge of the adaptations which are necessary and available.

Limitations of the Study

This study investigated a single subject, making generalizations to a population of low vision students inappropriate. However, the findings of this study provided implications which may be useful for educators of the visually handicapped. Rob used the microcomputer with success. Low vision did not impede his ability to read the video monitor except during times of severe visual fluctuations. Other visually handicapped students can also be expected to read video monitors. Because the microcomputer is not an adaptive aid unique to the visually handicapped, visually handicapped

students can potentially be mainstreamed more effectively when the equipment and the software are accessible.